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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/017,497	12/14/2001	Brian W. Baird	50001/83:2 USA	5632

3528 7590 10/04/2004

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EXAMINER

STACOVICI, STEFAN

ART UNIT	PAPER NUMBER
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1732

DATE MAILED: 10/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/017,497

Applicant(s)

BAIRD ET AL.

Examiner

Stefan Staicovici

Art Unit

1732

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 11 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) 34-37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-37 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/14/01;7/8/02.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☒ Other: IDS:10/21/02;12/11/02.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-33, drawn to a laser process, classified in class 264, subclass 400.
 - II. Claims 34-37, drawn to a laser apparatus, classified in class 219, subclass 121.69.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions Group I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case, the apparatus as claimed can be used to practice another and materially different process such as laser bonding of thermoplastic materials.
3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Mr. Michael Levine on August 10, 2004 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-33. Affirmation of this election must be made by applicant in replying to this Office action. Claims 34-37 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Specification

6. The abstract of the disclosure is objected to because the patent abstract is a concise statement of the technical disclosure of the patent and should include that which is new in the art to which the invention pertains. Correction is required. See MPEP § 608.01(b).

7. The disclosure is objected to because of the following informalities: the status of US patent applications mentioned in paragraph [0001] should be updated.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1 and 11-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Piwczyk *et al.* (US Patent No. 6,376,797 B1) in view of Cutler *et al.* US Patent No. 5,751,585) and in further view of Lundquist *et al.* (US Patent No. 6,255,621 B1).

Piwczyk *et al.* ('797) teach the basic claimed process of laser processing thin bodies of silicon using a Q-switched Nd:YAG pulsed laser beam (wavelength is shorter than 400 nm) having a spot diameter of 25 μm (see col. 7, line 38 and col. 9, lines 15-20) and a pulse energy of 500 μJ (col. 4, line 40). Further, Piwczyk *et al.* ('797) teach a plurality of pulses having a high repetition rate of 5-10kHz used to cut silicone substrates having a thickness of 700 microns and forming a kerf (see col. 4, lines 1-3 and 30-35).

Regarding claims 1, 11 and 17-18, Piwczyk *et al.* ('797) do not teach a controlling mechanism. Cutler *et al.* ('585) teach a laser controller including, fast and slow translational actuators (see Abstract). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a fast and a slow translational actuator as taught by Cutler *et al.* ('585) in the process of Piwczyk *et al.* ('797) because, Cutler *et al.* ('585) specifically teaches that such actuators provide improved positioning, hence improved laser machining and an improved process.

Further regarding claims 1, 11 and 17-18, Piwczyk *et al.* ('797) in view of Cutler *et al.* ('585) do not teach overlapping laser pulses. Lundquist *et al.* ('621) teach overlapping laser beam pulses when laser cutting a ceramic substrate (see Figure 4). Therefore, it would have been obvious for one of ordinary skill in the art to have overlapped the laser beam pulses as taught by Lundquist *et al.* ('621) when laser processing a silicon substrate in the process of

Piwczyk *et al.* ('797) in view of Cutler *et al.* ('585), because Lundquist *et al.* ('621) specifically teach that such a pattern provides for an improved product by eliminating edge defects of the resulting kerf (see col. 2, lines 20-25).

Specifically regarding claims 12-14, Piwczyk *et al.* ('797) teach the use of a gas cover during laser processing to avoid slag formation, lip formation and peel back of the kerf edge (see col. 2, lines 30-35).

Specifically regarding claims 15-16, Piwczyk *et al.* ('797) teach a plurality of pulses having a high repetition rate of 5-10kHz that form a kerf. Piwczyk *et al.* ('797) teach a curvilinear profile when laser cutting silicone in air (see col. 5, line 45-50).

10. Claims 19-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Piwczyk *et al.* (US Patent No. 6,376,797 B1) in view of Cutler *et al.* (US Patent No. 5,751,585) and in further view of Lundquist *et al.* (US Patent No. 6,255,621 B1) and Elliott *et al.* (US Patent No. 6,032,997).

Piwczyk *et al.* ('797) in view of Cutler *et al.* ('585) and in further view of Lundquist *et al.* ('621) teach the basic claimed process as described above.

Regarding claims 19-21, 23-28 and 30-32, Elliott *et al.* ('997) teach a glass (non-reflective to laser light) vacuum chuck for aligning and holding a wafer during processing. Further, Elliott *et al.* ('997) teach a method of aligning including, forming alignment marks on the back of the wafer (first and second features), placing the wafer on a transparent glass vacuum chuck, directing an alignment laser beam through the transparent glass vacuum chuck, and then redirecting alignment beam to strike the alignment marks on the wafer (see col. 3,

lines 60-67). Therefore, it would have been obvious for one of ordinary skill in the art to have used as an alignment tool a vacuum chuck as taught by Elliott *et al.* ('997) to cut the silicone substrate in the process of Piwczyk *et al.* ('797) in view of Cutler *et al.* ('585) and in further view of Lundquist *et al.* ('621) because, Elliott *et al.* ('997) teach that such a vacuum provides a variety of advantages when shaping a wafer (silicon material), whereas Piwczyk *et al.* ('797) teach laser cutting a silicone substrate, hence forming a kerf.

In regard to claims 22, 29 and 33, because Elliott *et al.* ('997) teach a glass vacuum chuck, it is submitted that glass (silicone) absorbs laser light in the ultraviolet region.

11. Claims 1-3, 11 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith *et al.* (US Patent No. 6,130,009) in view of Cutler *et al.* US Patent No. 5,751,585) and in further view of Owen *et al.* (US Patent No. 5,841,099).

Smith *et al.* ('009) teach the basic claimed process of forming vias in a silicon structure using a pulsed UV laser system.

Regarding claims 1-2, 11 and 17, Smith *et al.* ('009) do not teach a controlling mechanism. Cutler *et al.* ('585) teach a laser controller including, fast and slow translational actuators (see Abstract). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a fast and a slow translational actuator as taught by Cutler *et al.* ('585) in the process of Smith *et al.* ('009) because, Cutler *et al.* ('585) specifically teaches that such actuators provide improved positioning, hence improved laser machining and improved process control.

Further in regard to claims 1-2 and 11, although Smith *et al.* ('009) in view of Cutler *et*

al. ('585) teach a pulsed UV laser system, Smith *et al.* ('009) in view of Cutler *et al.* ('585) do not teach a spot size of less than 25 microns. Owen *et al.* ('099) teach a pulsed UV laser system generating a spot size of 25 microns. Therefore, it would have been obvious for one of ordinary skill in the art to have provided a spot size of 25 microns as taught by Owen *et al.* ('099) in the process of Smith *et al.* ('009) in view of Cutler *et al.* ('585) because, Owen *et al.* ('099) specifically teach that a pulsed UV system has a spot size of 25 microns whereas Smith *et al.* ('009) teach a pulsed UV laser system. It should be noted that Smith *et al.* ('009) teach a power density of 3 J/cm^2 , for a silicon substrate, whereas Owen *et al.* ('099) teach a spot size of 25 microns. Hence, it is submitted that by calculating the pulse energy as the product of the power density and spot area, the pulse energy is more than $200 \text{ } \mu\text{J}$. Further, it should be noted that Smith *et al.* ('009) teach a substrate thickness of $75 \text{ } \mu\text{m}$.

Further regarding claims 1-2 and 11, Owen *et al.* ('099) teach overlapping laser beam when drilling a hole (see Figures 3A and 3B). Therefore, it would have been obvious for one of ordinary skill in the art to have overlapped the laser beam as taught by Owen *et al.* ('099) when drilling a hole in the process of Smith *et al.* ('009) in view of Cutler *et al.* ('585), because Owen *et al.* ('099) specifically teach that such a pattern provides for improved process control.

Specifically regarding claim 3, Smith *et al.* ('009) teach a pulsed laser system. It is submitted that at least 5 pulses are being used. Further, Owen *et al.* ('099) teach a pulsed UV laser system using more than 5 pulses.

Regarding claims 15-16, Smith *et al.* ('009) teach a power density of 3 J/cm^2 , for drilling a hole (curvilinear profile) in a silicon substrate. Owen *et al.* ('099) teach a spot size of

25 microns. Hence, it is submitted that by calculating the pulse energy as the product of the power density and spot area, the pulse energy is more than 200 μ J.

12. Claims 4-10, 19-22, 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith *et al.* (US Patent No. 6,130,009) in view of Cutler *et al.* (US Patent No. 5,751,585) and in further view of Owen *et al.* (US Patent No. 5,841,099) and Elliott *et al.* (US Patent No. 6,032,997).

Smith *et al.* ('009) in view of Cutler *et al.* ('585) and in further view of Owen *et al.* ('099) teach the basic claimed process as described above.

Regarding claims 4-8, 10, 19-21, 31 and 32, Elliott *et al.* ('997) teach a glass (non-reflective to laser light) vacuum chuck for aligning and holding a wafer during processing. Further, Elliott *et al.* ('997) teach a method of aligning including, forming alignment marks on the back of the wafer (first and second features), placing the wafer on a transparent glass vacuum chuck, directing an alignment laser beam through the transparent glass vacuum chuck, and then redirecting alignment beam to strike the alignment marks on the wafer (see col. 3, lines 60-67). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a vacuum chuck as taught by Elliott *et al.* ('997) in the process of Smith *et al.* ('009) in view of Cutler *et al.* ('585) and in further view of Owen *et al.* ('099) because, Elliott *et al.* ('997) teach that such a vacuum provides a variety of advantages when shaping a wafer (silicon material), whereas Smith *et al.* ('009) teach laser processing a silicone substrate.

In regard to claims 9, 22 and 33, it is submitted that glass (silicone) absorbs laser light in the ultraviolet region.

13. Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith *et al.* (US Patent No. 6,130,009) in view of Cutler *et al.* (US Patent No. 5,751,585) and in further view of Owen *et al.* (US Patent No. 5,841,099) and Piwczyk *et al.* (US Patent No. 6,376,797 B1)

Smith *et al.* ('009) in view of Cutler *et al.* ('585) and in further view of Owen *et al.* ('099) teach the basic claimed process as described above.

Regarding claims 12-14, Piwczyk *et al.* ('797) teach the use of a gas cover during laser processing to avoid slag formation, lip formation and peel back of the kerf edge (see col. 2, lines 30-35). Therefore, it would have been obvious for one of ordinary skill in the art to have provided the gas cover of Piwczyk *et al.* ('797) in the process of Smith *et al.* ('009) in view of Cutler *et al.* ('585) and in further view of Owen *et al.* ('099) because, Piwczyk *et al.* ('797) teach the use of a gas cover during laser processing to avoid slag formation, lip formation and peel back of the kerf edge, hence providing an improved product.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stefan Staicovici, Ph.D. whose telephone number is (571) 272-1208. The examiner can normally be reached on Monday-Friday 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael P. Colaianni, can be reached on (571) 272-1196. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stefan Staicovici, PhD



Primary Examiner

9/30/04

AU 1732

September 30, 2004